IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF NEW JERSEY

RAJESH KUMAR, Plaintiff, v. THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC., Defendant.	Case No. 2:12-cv-06870-KSH-CLW DECLARATION OF RAJESH KUMAR IN SUPPORT OF MOTION FOR SUMMARY JUDGMENT

I, Rajesh Kumar, declare as follows:

1. I am the Plaintiff in the above-captioned lawsuit. I have personal knowledge of the matters set forth in this declaration and am competent to testify to them.

2. Attached hereto as **Exhibit A** is a true and correct copy of my doctoral dissertation, entitled “An Augmented Steady Hand System for Precise Micromanipulation” (the “Thesis”), which I completed in 2001 in connection with my Ph.D. in Computer Science from Johns Hopkins University (“JHU”).

3. My work as a computer scientist has focused on medical robotics, computer-assisted surgery and other human-machine interactions. I have worked in both academia and private industry, including in a senior position at Intuitive Surgical, Inc. where I developed the prototype that led to the now-widely used

da Vinci Si robotic surgery platform. The system developed from my prototype treats thousands of Americans every year for life threatening conditions. I have published over 100 patents and applications, books, chapters, articles and peer-reviewed conference papers. Attached hereto as **Exhibit B** is a true and correct copy of my curriculum vitae originally generated in 2011, containing a partial and representative list of my publications.

4. Attached hereto as **Exhibit C** is a true and correct copy of an email exchange between Dr. Gabor Fichtinger and me, dated January 17, 2013. Dr. Fichtinger is Associate Editor of IEEE Transactions on Biomedical Engineering, a journal published by The Institute of Electrical and Electronics Engineers, Inc. ("IEEE"), the defendant in this action. In his email, Dr. Fichtinger invited me to participate as a peer reviewer of a paper submitted for publication to that journal.

5. In 1996, I began my studies at JHU as a graduate student in Computer Science. There, I researched and developed new software architectures for computer-assisted surgery focusing on systems in which humans and robots perform surgical and other tasks cooperatively. For my Thesis, I worked primarily with the JHU "steady hand robot" which is a modular robotic test bed that I helped develop, and for which I wrote all of the robot control application programming interface ("API") software needed during my time as a graduate student. The steady hand robot performs force scaling, as compared to motion scaling, and

allows a user to manipulate a tool jointly with the machine. This reduces human tremor and enables extreme precision.

6. My Thesis (Exhibit A) is based on the five-plus years of research I conducted at JHU. I led and was personally responsible for the work described in the Thesis, which was funded in part with National Science Foundation grants.

7. The Thesis addresses how to generate simple, modular programming instructions (named "primitives") in a custom programming language that can be combined and transparently implemented to control the steady hand robot in order to execute complex, microscopic tasks in coordination with a human operator. I used visualizations called "task graphs" to visualize these complex tasks and to help implement the corresponding computer code to instruct the steady hand robot to perform the instructed complex motions. The task graphs decompose complex tasks into a series of more basic modules, each signifying a particular set of coding instructions.

8. The Thesis provides several increasingly complex example scenarios for implementing and testing my task graph programming. One experiment is based on retinal vein cannulation ("RVC"), a microsurgical technique that involves insertion of a minuscule tube, known as a micropipette, into a blood vessel in the retina to inject medicine. In addition to the broader research interests in the procedure, I had a very practical reason for choosing RVC as an experimental

example: it provided a non-clinical setting in which I could perform numerous trials in order to test the feasibility and effectiveness of the Thesis code in performing robot-augmented tasks. This was so because (a) porcine eyes were readily available for research purposes, and (b) I was able to persuade a small business, XACTIX Inc., to donate the micro-needles I needed to perform the experiment. The experiment involved using the robot to pierce very small porcine retina blood vessels with the micropipette, both with and without task-level augmentation code. The experiment confirmed the feasibility and effectiveness of the encoded task graphs shown in my Thesis, in a realistic surgical workspace.

9. RVC is not and has never been clinically performed on humans with steady-hand robotic assistance. My Thesis is not about RVC. It simply used RVC as an illustration of one of the experiments I devised to demonstrate my work.

10. As part of my Thesis work, I conceived and created a task graph representation of the RVC experiment (Thesis Figure 5.13). The task graph does not describe all the steps one would necessarily go through to actually perform RVC. Rather, it decomposes the main process into individual, programmable steps. I chose the level of abstraction at which to express these steps to reflect the particular needs of my experiment. Were the task graph to reflect an actual surgical procedure as opposed to a technological demonstration, for example, there would be no reason to describe “orient” and insert” as separate tasks; and I also

would have included therapy delivery instructions (the main goal of RVC).

11. Figure 5.13 of the Thesis is my original work. I created it to reflect the Thesis RVC experiment as it was coded. I also conceived the individual steps shown in the figure; their sequence; and the text descriptions contained in the Thesis. While these works reflect my general understanding of RVC, which I learned through clinical ophthalmology videos, they are not based on any pre-existing work. Each step of the task graph signifies substantial code that I created for the Thesis.

12. Attached hereto as **Exhibit D** is a true and correct copy of the Certificate of Registration for the Thesis, issued Sept. 25, 2001, by the U.S. Copyright Office. As noted therein, I was the registered author and sole copyright claimant. I remain so today.

13. Before I left JHU, I had prepared a manuscript that summarized some of the Thesis experiments. The paper was entitled "Simple Task-Level Augmentation of Microsurgical Scale Motion." I was the lead author and creator, and the other two secondary authors were JHU colleagues – my Thesis adviser, Dr. Russell H. Taylor, and Gregory D. Hager, who was a secondary reader of my Thesis. This manuscript contains (at Figure 8) a version of my task graph depicting the decomposition of RVC. It was submitted for potential publication in a special issue of a robotics journal edited by Dr. Taylor. It has never been

published. As is standard practice in academia, I never intended for this unpublished work to be disclosed to anyone but the journal and the attributed secondary authors unless and until it was published.

14. After obtaining my Ph.D., I left JHU for private industry in 2001.

15. I returned to JHU in 2007 as an assistant research professor, and started working on research not related to my Thesis. In 2010, while doing background research (on either Google Scholar or Xplore, IEEE's publication database) for a grant application to the National Science Foundation, I came across the article at issue in this lawsuit, "Task Modeling and Specification for Modular Sensory Based Human-Machine Cooperative Systems," by D. Kragic and Dr. Hager (the "IEEE Article"). I previously had been unaware of the IEEE Article's existence. It was published without my knowledge or permission. I had been severely ill in 2003 when the IEEE article was published.

16. I recognized immediately that the IEEE Article was based on my Thesis. Among other things, the Article discusses the same topic as the Thesis and describes the same strategy of programming higher-level tasks using graphically depicted coding primitives. Figure 1 of the IEEE Article illustrates this using RVC as an example, and contains the same, non-clinical, task decomposition of RVC that I conceived for my Thesis. The IEEE Article (at Section VIII) also contains an expression of the RVC task graph in code that is functionally the same as that

described in his Thesis, simply translating (on a practically point-by-point basis) the primitives from the Thesis into a different computer language (XML).

17. The IEEE Article contains a citation to my Thesis (reference [6]), but the citation is transposed with another, unrelated reference [5], in a way that misstates the work in the Thesis and obscures the overlap between it and the IEEE Article. Specifically, due to this error, the IEEE Article states that the unrelated reference [5] "studies augmented surgical manipulation tasks in order to create an environment that makes it possible to easily and safely specify a set of control primitives (basic control modules) necessary for a number of different surgical procedures." This was not the topic of reference [5]; it was the very heart of my Thesis. The IEEE Article instead falsely attributes to the Thesis an assertion it does not make: that the Thesis "is concerned with the issue of providing the appropriate assistance to the users by recognizing their actions using continuous Hidden Markov Models." I pointed out this obvious error to IEEE by no later than March 2012. IEEE did not correct it until December 2012.

18. Dr. Kragic and Dr. Hager subsequently re-used their RVC task graph (IEEE Article Figure 1) in other publications they co-authored with other collaborators. The publishers of these later works have issued statements or errata noting that I should have been acknowledged in connection with the task graph. Attached hereto at **Exhibit E** is a true and correct copy of an article this author

group published in 2005 in The International Journal of Robotics Research ("IJRR"), with the Publisher's Statement about my task graph in the second page of the exhibit. The article was also adopted into a book chapter in a work published by Springer-Verlag Berlin Heidelberg. Springer-Verlag has also published an Erratum to that chapter noting my Thesis task graph. A true and correct copy of that Erratum is attached hereto as **Exhibit F**.

19. I initially brought my concerns about the IEEE Article to JHU administrators because the work was co-authored by Dr. Hager, a JHU colleague, and by then my supervisor as the chair of my department. JHU responded by (a) summarily finding there had been no violations of the university's research misconduct policies, and (b) retaliating against me in employment. I was subsequently forced to pursue an employment lawsuit against JHU. On April 23, 2014, a jury in Baltimore found (among other things) that JHU had wrongfully retaliated against me because I had pursued the research complaint. Attached hereto as **Exhibit G** is a true and correct copy of the jury verdict so finding.

20. I also brought my concerns over the IEEE Article to IEEE. IEEE initially asked only a single officer, Alessandro De Luca, to review my complaint. Dr. De Luca was the thesis advisor of another graduate student, Alessandro Bettini, who had preceded Dr. Kragic as a visitor at JHU and had likewise collaborated with Dr. Hager. Attached hereto as **Exhibit H** is a true and correct copy of an

article co-authored by Bettini and Hager.

21. I created my RVC task graph (Thesis Figure 5.13) using an open source graphic software program called Xfig. I am well versed in the use and operation of Xfig. I have used it often, and understand its operation. For reference, the Xfig user manual may be found at http://www.xfig.org/userman/fig-format.html.

22. Attached hereto as **Exhibit *I*** is a true and correct copy of my Xfig source file for Thesis Figure 5.13, as opened and printed through a text editor. The file was stored for back up purposes on my laboratory network drive at JHU at the time I completed my Thesis, and would have been accessible to anyone with administrative access to that shared network.

23. As a user enters figure elements into the Xfig graphical user interface (GUI), the software saves the geometric properties of the figure elements as lines of text in the corresponding source file. The header (first portion) of the resulting source file shows the version of the software used in the first line, and then the following user-designated formatting options, in this order: (i) orientation (portrait or landscape); (ii) justification; (iii) units (metric or inches); (iv) paper size; (v) magnification; (vi) pagination; and (vii) color. Thus, for my task graph (Exhibit *I*), the figure was portrait-oriented, center-justified and created in inches. The paper size is "letter," the magnification is 100 percent, it is formatted as a single-page

illustration, and the color code (-2) means there is no color. These are settings that I chose when I created Thesis Figure 5.13.

24. The rest of the source file shows the individual objects the user created in the same order the user created or edited them for any Xfig file. Each line in the source file begins with the number that corresponds to a particular object (there are only 6 choices; for example, 1 is an ellipse, 4 is text, and 5 is an arc), followed by a number for a specific defined sub-type of that object. For example, the source file for my task graph (Exhibit *I*) shows that the first three elements I drew for Figure 5.13 were an open-ended arc (that is, an arc (5) of sub-type 1 – shown as "5 1"); then an ellipse defined by its radii (sub-type l -- "1 1"); and then another arc of sub-type 1 ("5 1") representing another arrow in the task graph. The remaining numerals on each line describe the geometric properties – for example, position and size – for these elements.

25. Attached hereto as **Exhibit J** is a true and correct copy of a file named "vc.fig" as opened and printed through a text editor. This file was produced electronically by Danica Kragic in this litigation, and is taken from the "IEEE_IROS_2003" folder of the thumb drive she provided to this Court. I understand Dr. Kragic has testified that vc.fig is the source file for Figure 1 of the IEEE Article, its RVC task graph.

26. Attached hereto as **Exhibit K** is a document I have prepared showing

Exhibits *I* (my task graph source file) and J (Kragic's task graph source file) side by side, with red underlines and brackets added to highlight some of the many key similarities in these selections. This comparison shows that each element of Dr. Kragic's task graph was created in the same sequence and same manner of construction as my task graph, with the same document settings, formatting, and stylistic elements. First, the header of the two source files is identical, except that Dr. Kragic's figure has been rotated from portrait to landscape. (It is of note here that as in my task graph, the chosen unit for her task graph is inches, and the chosen paper size is "letter." For a European user like Dr. Kragic using Xfig to print a figure, the default settings logically should be "metric" and "A4," respectively.) Next, the initial ten elements of the two task graphs (the "top" part of Exhibit K) are identically defined: Dr. Kragic's figure was created with the same sub-type arcs and ellipses, in the same order, as my figure. Similarly, taking a selection from the "middle" of Exhibit K shows identical formatting and identical objects, entered in the identical order, with even the first text inserted being the same "Orient" word transitioning from arcs and ellipses to text words. Finally, most of the text in both task graphs appears in identically ordered blocks. As highlighted by the brackets in the "bottom" portion of Exhibit K, Dr. Kragic's version contains a block of six lines of code related to text for "button 1" and "button 2" that is identical to the similar block in my code, but simply transposed

with another six-line block of code for the "error" text. Within both blocks, the line order is the same and the content is very similar.

27. Creating a figure in Xfig's simple GUI requires manual entry of each individual element – ellipse, arc, and text. Given that the two task graph figures at issue have over a hundred elements, there is no practical explanation for the correlations in the source files noted above, other than that Exhibit *I* was the original source for Exhibit J.

I declare under penalty of perjury under the laws of the state of the United States of America that the foregoing is true and correct.

Executed at Fremont, California, this 15 day of February, 2015.

Rajesh Kumar

Rajesh Kumar